A51

Simpson

INSTRUMENTS THAT STAY ACCURATE

OPERATOR'S MANUAL

260® or 270

VOLT-OHM-MILLIAMMETER

Bach-Simpson

LIMITED

LONDON CANADA

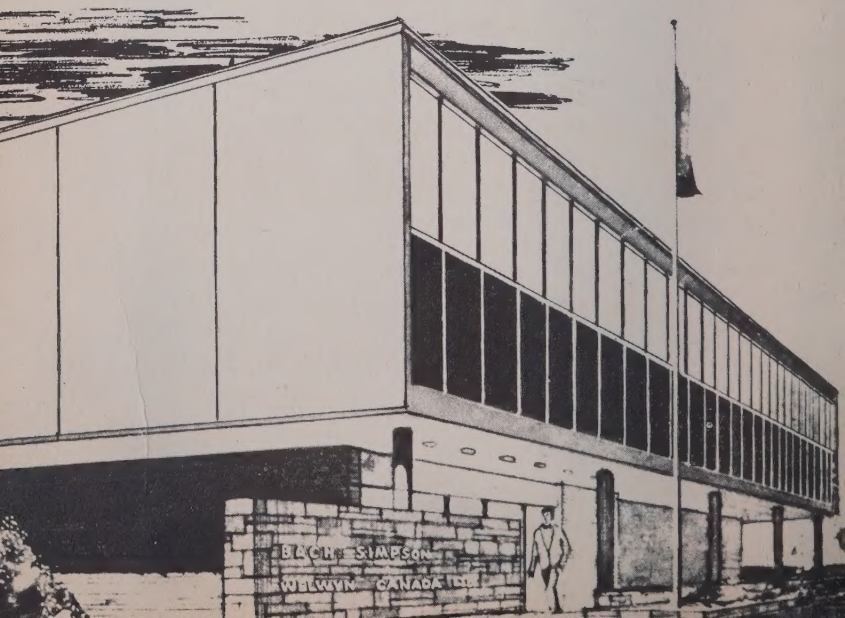
IN U.S.A. SIMPSON ELECTRIC COMPANY

5200 W. Kenzie St. Chicago 44, Ill.

ABOUT BACH-SIMPSON

From its origins during World War II, Bach-Simpson Limited has steadily expanded its facilities, so that virtually all operations involved in transforming idea into finished product are now performed under one roof. With sister company Welwyn Canada Limited, it occupies a modern factory and office covering nearly 50,000 square feet, and housing more than 300 skilled employees.

In recognition of the growing need for precision electrical products of high quality, its output has become steadily more diversified, ranging from panel meters to complex electronic and control equipment. These have gained an international reputation which we strive constantly to maintain and enhance.



MANUAL PART NO. 6864

OPERATOR'S MANUAL

260® or 270

VOLT-OHM-MILLIAMMETER

Model 260 Series III
Model 260 Series IIIS

Model 270 Custom Series
Model 270 Custom IIIS

Manufactured in Canada by

BACH-SIMPSON LTD. LONDON CANADA
P.O. Box 2484 1255 Brydges St.

IN U.S.A. SIMPSON ELECTRIC COMPANY
5200 W. Kenzie St. Chicago 44, Ill.

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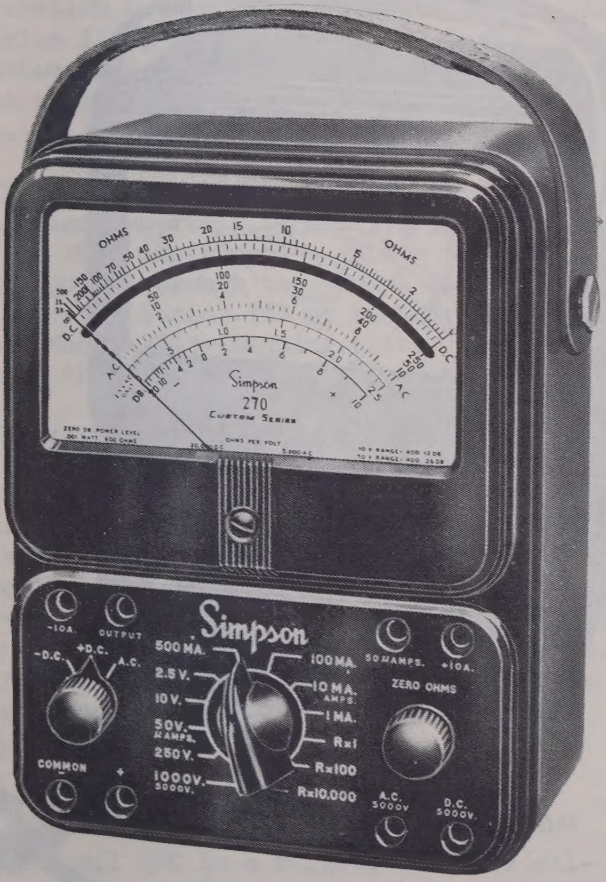
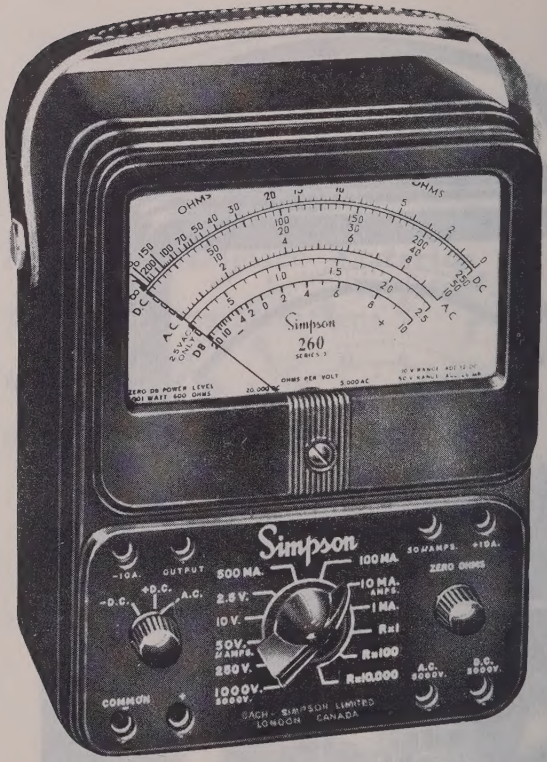
INDEX

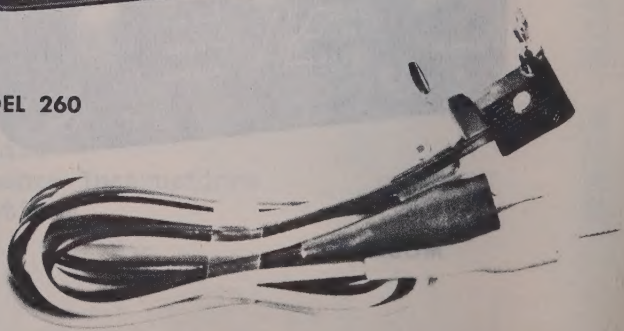
	Page
Illustration Model 270	3
Illustration Model 260	4
Foreword	5
Physical Description - Exterior	7
- Interior	8
Electrical Specifications	9
Accessories	12
Operating Instructions - General	13
- D.C. Voltage - 0 - 250 MV.	13
- to 1000 Volts	14
- 5000 Volts	16
- A.C. Voltage - to 1000 Volts	17
- 5000 Volts	19
- Output Voltages	19
- Volume Levels, DB	21
Frequency Corrections	18,20
- Resistance Measurements	22
- D.C. Current - to 50 ua	24
- 50 ua to 500 ma	26
- 500 ma to 10 A	27
Schematic Diagram	28
Parts List	29
Maintenance Instructions	30
Applications	35


OHMS
OHMS
Simpson
270
CUSTOM SERIES
Simpson
-10A.
OUTPUT
-D.C.
+D.C.
A.C.
COMMON
500 MA.
2.5 V.
10 V.
50 V.
25 AMPS.
250 V.
1000 V.
5000 V.
100 MA.
10 MA.
25 AMPS.
1 MA.
Rx1
Rx100
Rx10,000
50 AMPS.
+10A.
ZERO OHMS
A.C.
5000 V.
D.C.
5000 V.

MODEL 270


Simpson
260
SERIES 3
-10A.
OUTPUT
+10A.
-D.C.
+D.C.
A.C.
500 MA.
2.5 V.
10 V.
50 V.
25 AMPS.
250 V.
1000 V.
5000 V.
100 MA.
10 MA.
AMPS.
1 MA.
Rx1
Rx100
Rx10,000
50 AMPS.
+10A.
ZERO OHMS
A.C.
5000 V.
D.C.
5000 V.
COMMON
SIMPSON LIMITED
LONDON CANADA

MODEL 260



FOREWORD

Because of the similarities in appearance and operation between the Model 260 Series III and Series IIIS, and the Model 270 Custom Series and Custom IIIS, it has been found expedient to produce a single Operator's Manual for all Models.

Throughout the text, where the information applies generally to all four, we refer simply to "the instrument". Where necessary, we distinguish between the "Model 260" (meaning either the Series III or the Series IIIS) and the "Model 270" (meaning either the Custom Series or the Custom IIIS).

The significant difference between the Model 260 Series III and the Series IIIS lies in the use of a self-shielding (S) movement in the latter, which protects it from the influence of external fields. This also ensures that the leakage field from the movement is so low as to produce negligible disturbance of sensitive instruments operated in the near vicinity. The above applies equally to the Model 270 Custom IIIS, distinguishing it from the Model 270 Custom Series.

* * * * *

The Model 260 is a rugged, reliable all-purpose measuring instrument. It is used for measuring A.C. and D.C. voltages, D.C. currents, resistances, volume levels, and audio output voltages. Protective fusing and spring-backed jewels provide protection against the hazards of day-to-day use.

The Model 270, in the same convenient physical form and offering the same comprehensive series of ranges, provides enhanced accuracy, achieved by the use of 0.5% resistors, combined with a premium meter movement in which special precautions have been taken to minimize errors.

To allow the operator to utilize this superior accuracy, the meter scale is provided with an anti-parallax mirror. The highly legible markings and buff-tinted background are designed for easy, accurate reading and reduced fatigue.

To preserve this high degree of accuracy in everyday use, spring-backed jewels and fuse are supplemented by a protective diode, which limits the otherwise damaging acceleration to which movement and pointer might be subjected in the case of accidental overload. Temperature compensation assures that rated accuracy will be maintained on all A.C. and D.C. ranges over the span of temperatures normally encountered in workshops and laboratories.

Spring-backed jewels, fuse, protective diode, and intrinsic ruggedness provide a great measure of protection against the effects of the frequent handling and occasional accidental misuse to which such a versatile instrument is inevitably subjected. There is no substitute, however, for care and proper operation of your multimeter. Given these, your Model 260 or Model 270 will provide you with many years of accurate, dependable service.

PHYSICAL DESCRIPTION. EXTERIOR

The instrument consists of a molded black front panel on which all components are mounted, and a sturdy molded black phenolic case with reinforced walls for maximum durability. The panel assembly can be removed from the case in one piece.

The upper portion of the front panel is taken up entirely with the meter. The lower portion carries the lead connecting jacks, the function and range switches, and the ohms adjust control. All switch positions and jacks are labelled with molded-in white-filled lettering for long term readability.

RANGE SWITCH: In the center of the lower front panel, this has twelve positions. It can be rotated through 360° in either direction to the desired range setting.

FUNCTION SWITCH: On the left of the lower front panel, this has three positions, AC, +DC, -DC. For D.C. or resistance measurements +DC is normally selected. On all but the 50UA/250MV and 10A ranges, the test lead connections can be reversed without removing them from the circuit under test by switching to -DC.

ZERO OHMS CONTROL: On the right of the lower front panel, this is a variable resistance in the ohmmeter circuit which corrects for variations in the internal batteries. It is used to adjust the meter indication to "zero ohms" at the right hand end of the scale before resistance readings are made.

PHYSICAL DESCRIPTION - EXTERIOR

CIRCUIT JACKS: There are eight of these in all, into which the connector ends of the test leads are plugged. The "Common-" and "+" jacks are used for most ranges, with the black test lead plugged into the former, the red into the latter. Exceptions are the 10 Amp D.C., Output, 50 μA/250 MV, and 5000 V A.C. and D.C. ranges. Connections in these cases are covered in the individual instructions.

DIMENSIONS: 5-1/4" x 7" x 3-1/8"
133 x 178 x 79 MM

WEIGHT: 3-1/2 lbs. (1.6 Kg)

PHYSICAL DESCRIPTION - INTERIOR

PRINTED CIRCUIT: With minor exceptions, circuit components are mounted on a single printed circuit board; this simplifies assembly, reduces maintenance and extends the useful life of the instrument.

BATTERIES: One 1.5V size D battery, and four 1.5V size AA batteries supply voltage for resistance measurement. The size D battery alone powers the R x 1 and R x 100 ranges; the AA batteries supplement it on the R x 10,000 range.

All are held in place by special contact clips, while additional security is provided by the special shape of the inside of the molded case when this is in place. Polarities are marked, and must be observed when batteries are replaced.

FUSE: A fuse block is mounted on the two circuit board support posts, carrying a 1 amp miniature clip-in fuse. (Note: Units produced prior to August 1961 may incorporate a soldered-in pig-tail fuse). See note under Maintenance.

ELECTRICAL SPECIFICATIONS

RANGES:

D.C. VOLTAGE	SENSITIVITY
0-250 Millivolts	20,000 ohms per volt
0-2.5 Volts	
0-10 "	
0-50 "	
0-250 "	
0-1000 "	
0-5000 "	

A.C. VOLTAGE	SENSITIVITY
0-2.5 Volts	5,000 ohms per volt
0-10 "	
0-50 "	
0-250 "	
0-1000 "	
0-5000 "	

A.F. OUTPUT VOLTAGE	With 0.1 mfd. internal series capacitor.
0-2.5 Volts	
0-10 "	
0-50 "	
0-250 "	

VOLUME LEVEL	With zero DB equal to 1 Milliwatt across a 600 ohm line.
-20 to +10 DB	
-8 to +22 DB	
+6 to +36 DB	
+20 to +50 DB	

ELECTRICAL SPECIFICATIONS

D.C. RESISTANCE

R x 1	0-200 ohms (12 ohms center)
R x 100	0-20,000 ohms (1200 ohms center)
R x 10,000	0-2 Megohms (120,000 ohms center; visible indication to 20 megohms)

D.C. CURRENT	INSERTION LOSS
0-50 μA	250 MV. Drop Approx.
0-1 MA	
0-10 MA	
0-100 MA	
0-500 MA	
0-10 A	

FREQUENCY RESPONSE

These instruments have an excellent frequency response, being essentially "flat" through the range from 20 cycles per second to 50,000 cycles per second. Correction curves covering the higher frequencies appear on Page 18. Calibration on A.C. ranges is for R.M.S. of sinusoidal waveforms.

TEMPERATURE EFFECT

Temperature compensation assures maintenance of rated accuracy on D.C. ranges for the temperature range $25^{\circ}C \pm 5^{\circ}C$ for both Models 260 and 270. Additional compensation circuits in the Model 270 assure the maintenance of rated accuracy over this temperature range on A.C. ranges also.

ELECTRICAL SPECIFICATIONS

ACCURACY - MODEL 260

The accuracies of the Model 260 are ±3% of full scale for all D.C. voltage and current ranges, and ±5% for A.C. voltages. Resistances read within 3° of arc of their absolute values as marked on the dial.

ACCURACY - MODEL 270

D.C. RANGES--

Effective Range, 10% to 100% of full scale

Current to 10A	±1.25% of full scale
Voltage to 250V	±1.25% of full scale
1,000 V Range	±1.75% of full scale
5,000 V Range	±2.5% of full scale

A.C. RANGES--

Effective range, 20% to 100% of full scale

Voltage to 1,000 V	±2.25% of full scale
5,000 V Range	±3% of full scale

RESISTANCE RANGES--

Effective Range, 10% to 90% of full scale (angular)

At centre scale	Better than 5% of reading
At limits of effective range	Better than 10% of reading

ACCESSORIES SUPPLIED

LEAD SET (Part #3638): Two 4' leads, one red, one black, with molded right angle connector plugs and rubber sleeved alligator clips are supplied with each instrument. The wire is finely stranded and very flexible, and the insulation safe for all voltages to which your instrument will be subjected.

Nevertheless, when measuring high voltages, observe the standard precaution of clipping the lead to the connection with power off. Then restore power and read the instrument, keeping the hands clear of leads and equipment.

ACCESSORIES AVAILABLE

LEAD SET (Part #3686): As above, but with test prods instead of alligator clips.

HIGH VOLTAGE D.C. PROBE (Part #0247): 25 KV probe, tubular plastic handle housing multipliers.

CASES (Part #7031-1): Brown leather "Eveready" style, into which the instrument can be permanently fastened with the handle mounting studs. Front flap lifts up to expose the whole front panel in use.

(Part #7237): Black leather pouch type.

ADD-A-TESTER UNITS: These are too numerous and complex to describe fully in this manual. However, by plugging the desired unit into your instrument, you can convert the latter to function as a transistor or temperature tester, DC VTVM, Audio Wattmeter, Battery Tester, AC Ammeter or Microvolt Attenuator. Your present case must be replaced with one designed to lock the Add-A-Tester in place. Conversion kits are available. See Parts List.

OPERATING INSTRUCTIONS. GENERAL.

CHECK ZERO SETTING. Before making measurements, observe whether the meter pointer rests on the zero mark, with the tester in the position in which you intend to use it. (It is good instrument practice to lay the tester on its back, scale horizontal, to avoid the danger of tipping it over.) If necessary, set the pointer to the center of the zero scale division, using the slotted button in the lower center of the meter cover. This button rotates freely through 360°.

OBSERVE CAUTION. For your personal protection, turn off power to the circuit under test before connecting your multimeter. For the protection of your instrument, check jack connections and settings of range and function switches before restoring power. Switch off again before disconnecting leads.

OPERATING INSTRUCTIONS. SPECIFIC.

D.C. VOLTAGE MEASUREMENTS

0 - 250 MILLIVOLT RANGE ONLY. (NOTE: accidental overloads can be particularly damaging here in the case of the Model 260, and caution is advisable even with the diode-protected Model 270.)

Step 1. Set the function switch at + DC.
2. Plug the black test lead into the COMMON-jack, and the red lead into the 50 μAMP jack.
3. Set the range switch to the 50 μAMP (50 V) position.

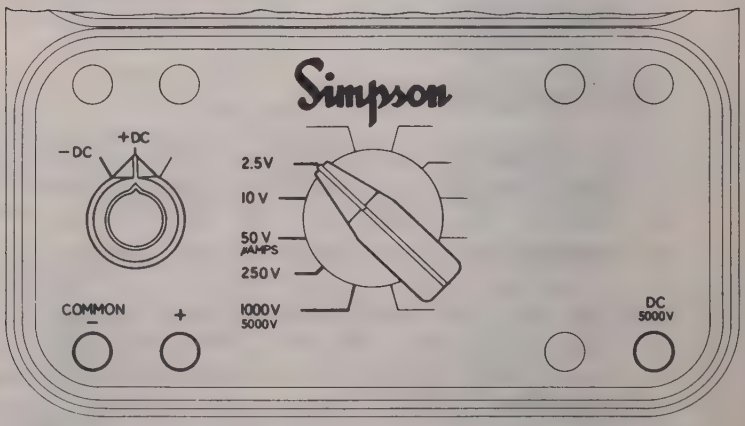
Step 4. Connect the black test lead to the negative side of the circuit to be measured, and the red lead to the positive side of the circuit.

5. Turn on power. If the meter deflects to the left of zero, switch off promptly and reverse the connections (the function switch with its polarity reversing feature is not in circuit on this range). Restore power.

6. Read voltage on the black arc marked DC. Use the figures 0-250 which give a direct reading in millivolts.

7. Turn off power and disconnect leads.

VOLTAGE RANGES TO 1000V.



CONTACTS AND SWITCH POSITIONS FOR D.C. VOLTS.

D.C. VOLTAGE RANGES TO 1000V.

1. Set the function switch on the left hand side of the front panel at +D.C.
2. Plug the black test lead into the COMMON-jack and the red test lead into the + jack.
3. Set the range selector switch in any of the five voltage range positions. These are marked 2.5V., 10V., 50V., 250V., and 1000V. When in doubt as to the voltage present, always select the highest voltage range as a protection to the instrument.
4. Connect the black test lead to the negative side of the circuit to be measured and the red test lead to the positive side.
5. Turn on the power in the circuit to be tested. If the pointer deflects to the left of zero, the anticipated polarity is opposite the actual circuit polarity. Turn off the power, set the function switch at -D.C., and turn on the power again. This will correct the polarity.
6. Observe the meter reading. If the voltage can be measured on a lower range, the switch may be set to select this range to obtain a more accurate reading. Read the voltage on the black arc marked D.C. which is second from the top of the dial.
   For the 2.5 V. range use the 0-250 figures and divide by 100.
   For the 10 V., 50 V., and 250 V. ranges read the figures directly from the scale.
   For the 1000 V. range use the 0-10 figures and multiply by 100.
7. Turn off the power in the circuit which is being measured before disconnecting meter leads.

OPERATING INSTRUCTIONS

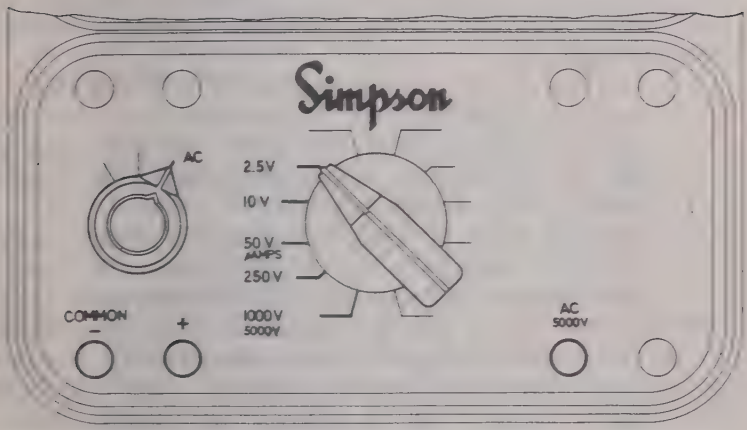
0-5000 VOLT D.C. RANGE ONLY.

WARNING: Be extremely careful when working in high voltage circuits. Do not touch the meter or test leads while power is on in the circuit being measured.

---

1. Set the function switch at +D.C.
2. Set the range selector switch at 5000 V.
3. Connect the black test lead into the COMMON- jack and the red test lead into the D.C. 5000 V. jack.
4. Be sure that power is off in the circuit to be measured and that all capacitors have been discharged. Connect the black test lead to the negative side of the circuit to be measured and the red test lead to the positive side.
5. Turn on the power in the circuit. Do not touch the meter or test leads. If the pointer deflects to the left side of zero, the anticipated polarity is opposite the actual circuit polarity. Turn off the power in the circuit being tested. Set the function switch at -D.C., and turn on the power again. This will correct the polarity and the meter pointer will deflect to the right.
6. Read the voltage using the 0-50 figures on the black arc which is second from the top of the scale. Multiply the reading by 100.
7. Turn off the power before disconnecting the test leads.

MEASURING A.C. VOLTAGES TO 1,000 VOLTS



CONTACTS AND SWITCH POSITIONS FOR A.C. VOLTS.

1. Set the function switch at A.C.
2. Set the range selector switch in any of the five voltage range positions, marked 2.5 V., 10 V., 50 V., 250 V., and 1000 V. When in doubt as to the voltage present, always select the highest voltage range as a protection to the instrument.
3. Plug the black test lead into the COMMON- jack and the red test lead into the + jack.
4. Be sure power is turned off in the circuit to be measured and connect the test leads across the voltage source.

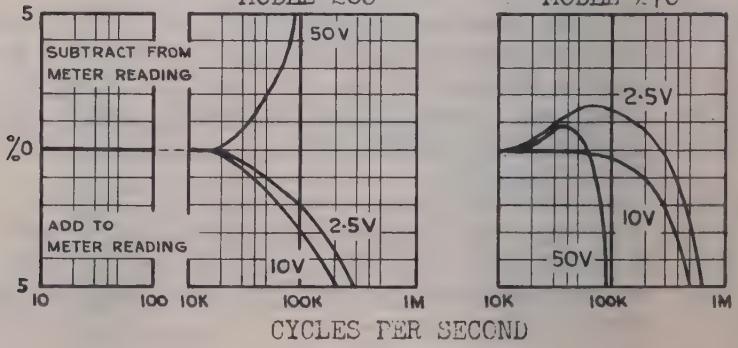
5. Turn on the power in the circuit to be measured. Observe the meter reading. If the voltage can be read on a lower range, the switch may be set for this range to obtain a more accurate reading.

For the 0-2.5 V. range read the value directly on the special arc marked 2.5V. AC ONLY.

For the 10V., 50V., and 250V. ranges read the red arc marked A.C. and use the black figures immediately above the arc.

For the 1000 V. range read the red arc marked A.C. Multiply the 0-10 figures by 100.

The Simpson Models 260 and 270 measure A.C. RMS voltage using two germanium diodes in a modified full wave bridge circuit especially designed to give a wide frequency response. They are useful over a range from 10 cycles to 500,000 cycles per second. The curves below show the response of the 2.5, 10, and 50 volt ranges. The 2.5 and 10 volt ranges are within 5% from 10 to 100 KC/S.



FREQUENCY CORRECTION - MODELS 260 and 270

MEASURING A.C. VOLTAGE TO 5000 VOLTS

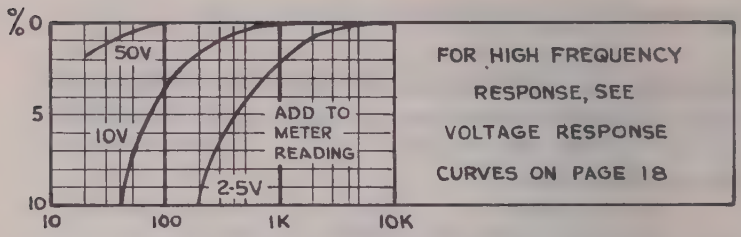
WARNING: Be extremely careful when working on high voltage circuits. Do not touch the meter or test leads while power is on in the circuit being measured.

1. Set the function switch at A.C.
2. Set the range selector switch at 5000 V.
3. Connect the black lead to the COMMON-jack and the red lead to the A.C. 5000 V. jack.
4. Be sure power is off in the circuit to be measured and that all its capacitors have been discharged. Connect the test leads.
5. Turn on the power in the circuit to be measured. Do not touch the meter or test leads.
6. Read the voltage on the red arc marked A.C. Use the 0-50 figures and multiply by 100.
7. Turn off the power before disconnecting the test leads.

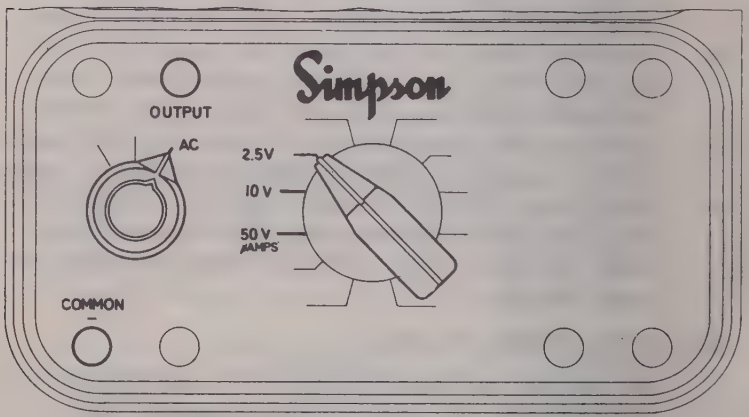
MEASURING OUTPUT VOLTAGES

An output voltage is the A.C. component only, in a mixture of A.C. and D.C. voltages. This occurs mostly in amplifier circuits.

Models 260 and 270 have a capacitor in series with the OUTPUT jack. This blocks the D.C. component of the current, but allows the desired A.C. component to pass on to the meter circuit. The blocking capacitor alters the A.C. response. The following curves show the frequency range over which the accuracy is within ±10%. However, the instrument is useful up to 600 kilocycles per second.



LOW FREQUENCY CORRECTION FOR OUTPUT MEASUREMENTS



CONTACTS AND SWITCH POSITIONS FOR OUTPUT.

1. Set the function switch on the left hand side of the front panel at A.C.
2. Connect the black test lead in the COMMON- jack and the red test lead in the OUTPUT jack.
3. Set the range selector switch at the desired range position. These are marked 2.5 V., 10 V., 50 V., and 250 V.

4. Connect the black test lead to the grounded side of the circuit to be measured and the red test lead to the "hot" side.
5. Turn on the power in the circuit. Read the output voltage on the A.C. voltage arcs of the dial.
   For the 0-2.5 V. range read the value directly on the special arc marked 2.5 V.A.C. ONLY.
   For the 10 V., 50 V., and 250 V. ranges use the red arc marked A.C. and read the black figures immediately above the arc.
6. Turn off the power in the circuit before disconnecting the leads.

MEASURING DECIBELS

Output voltages and audio frequency voltages are frequently measured in terms of decibels. To do this, proceed according to the instructions for measuring output or AC voltage as appropriate. Read the DB scale, which is numbered from -20 through 0 to +10, and is the lowest arc on the dial.

The DB readings obtained will be correct on an absolute scale if you are using a 0 DB power level of .001 watt in 600 ohms, and if the voltage which you read is measured across 600 ohms.

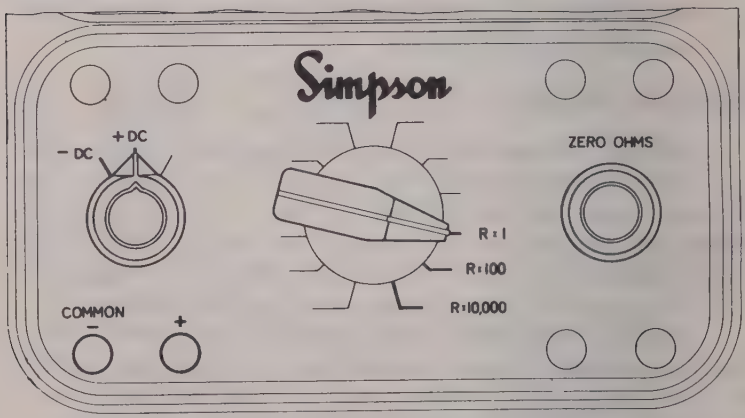
To obtain absolute DB values across 600 ohms:

For the 10 V. range read the DB arc and add +12 DB to the reading.
For the 50 V. range read the DB arc and add +26 DB to the reading.
For the 250V. range read the DB arc and add +40 DB to the reading.

If the reference level is 0 DB = .006 watt in 500 ohms, subtract (+)7 DB from the reading to obtain the absolute value of decibels.

OHMMETER CIRCUIT

When resistances are measured in ohms, the batteries inside the case furnish power for the circuit. Since the batteries are subject to deterioration over long periods of time, there is a compensating circuit in the ohmmeter to make it possible to extend the useful life of the batteries.



CONTACTS AND SWITCH POSITIONS FOR RESISTANCES.

ZERO OHMS ADJUST

Each time you use the ohmmeter circuit, check the zero indication at the right hand end of the ohms scale before you measure any resistance. Check and adjust it each time you switch to a different range. To set ZERO OHMS proceed as follows:

OPERATING INSTRUCTIONS

1. Set the range switch at the desired resistance range position and the function switch at either -D.C. or +D.C.
2. Connect the black test lead in the COMMON- jack and the red test lead in the + jack.
3. Clip the contact ends of the test leads together to produce zero resistance.
4. Observe the meter indication. It should read on zero at the right hand end of the OHMS arc at the top of the scale.
5. If the pointer does not read zero, set it on the line with the ZERO OHMS control. If this cannot be done, one or more batteries need to be replaced.
6. When the zero has been adjusted, unclip the shorted test leads; the ohmmeter circuit is now ready to measure resistance.

MEASURING RESISTANCES

To measure resistance, proceed as follows:

1. Set the range switch in one of the resistance range positions.
   Use R x 1 for resistance readings from 0 to 200 ohms.
   Use R x 100 for resistance readings from 200 to 20,000 ohms.
   Use R x 10,000 for resistance readings above 20,000 ohms.
2. Set the function switch at either -D.C. or + D.C.
3. Connect the black test lead in the COMMON- jack and the red test lead in the + jack.

4. Short the test leads together and adjust for zero ohms (see instructions above).
5. Separate the test leads and connect them across the resistance which is to be measured. If there is a "Forward" and "Backward" resistance such as in rectifiers, switch back and forth between the two D.C. positions of the function switch to reverse this polarity.

NOTE: The resistance of such rectifiers will measure different values on different resistance ranges of the 260 and 270. Thus, a crystal diode which measures 80 ohms, for example, on the R x 1 range may measure 300 ohms on the R x 100 range. This is normal, and is a result of the diode characteristic. The difference in values does not indicate any fault in the ohmmeter.

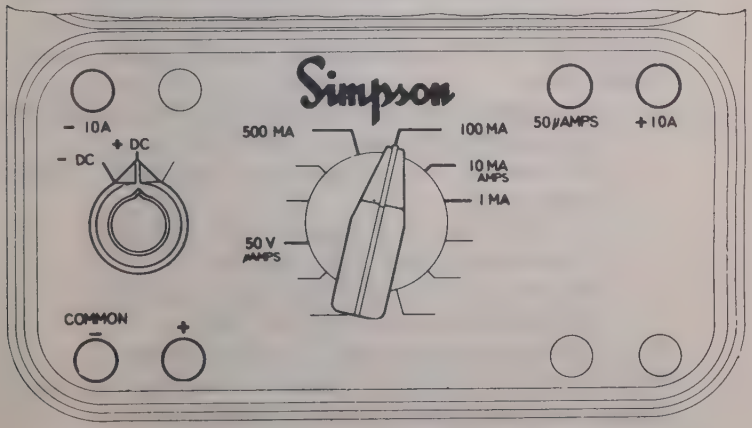
6. Read the indication on the OHMS arc at the top of the dial. Note that this arc reads from right to left for increasing values.
7. Multiply the reading by the multiplier factor shown at the switch position to obtain the resistance value in ohms. "K" on the dial stands for "thousand."

MEASURING DIRECT CURRENTS, 0 to 50 MICROAMPERES

CAUTION: Never connect the test leads directly across any voltage when the instrument is used as a current meter. Always connect the meter in series with the load across the voltage source to avoid damage.

OPERATING INSTRUCTIONS

1. Set the function switch at +D.C.
2. Connect the black test lead in the COMMON- jack and the red lead in the 50 UAMPS jack.
3. Set the range switch at 50 UAMPS (50 V.).
4. Open the circuit in which the current is to be measured. Connect the meter in series with it, the red lead toward the positive side, and the black test lead to the negative.
5. Turn on the power in the circuit which is to be measured. Observe the meter. If the pointer is deflected to the left, the current polarity is reversed. Turn off the power and reverse the leads (the function switch is not in circuit on this range). Turn on power.
6. Read the current directly on the black D.C. arc. Use the 0-50 figures. The current value is shown in microamperes.
7. Turn off the circuit power. Remove the test leads and restore the circuit continuity.



CONTACTS AND SWITCH POSITIONS FOR DIRECT CURRENTS.

MEASURING DIRECT CURRENTS, 50 MICROAMPERES TO 500 MILLIAMPERES

1. Set the function switch at +D.C.
2. Connect the black test lead in the COMMON- jack and the red test lead in the + jack.
3. Set the range switch in any of the four range positions required. These are marked 1 MA., 10 MA., 100 MA., and 500 MA. When in doubt as to the current flowing, always select the highest range initially.
4. Open the circuit which is to be measured and connect the meter in series. Connect the red test lead toward the positive side and the black test lead toward the negative side.
5. Turn on the power in the circuit. Observe the meter. If the pointer is deflected to the left, the current polarity is opposite to that which was anticipated. Turn off the power, set the function switch to -D.C. and restore the power.
6. Read the current directly on the black D.C. scale arc.
   For the 1 MA. range use the 0-10 figures and divide by 10.
   For the 10 MA. range use the 0-10 figures directly.
   For the 100 MA. range read the 0-10 figures and multiply by 10.
   For the 500 MA. range read the 0-50 figures and multiply by 10.
   The current values are in milliamperes.
7. Turn off the circuit power. Remove the test leads and restore circuit continuity.

OPERATING INSTRUCTIONS

MEASURING DIRECT CURRENTS, 500 MILLIAMPERES TO 10 AMPERES

1. Connect the black test lead in the -10 A. jack and the red test lead in the +10 A. jack.
2. Set the range selector switch at 10 AMPS (common with 10 MA.).
3. Open the circuit which is to be measured. Connect the meter in series with the circuit. Connect the red test lead toward the positive side and the black test lead toward the negative side.
4. Turn on the power in the circuit which is to be measured. Observe the meter. If the pointer is deflected to the left, the current polarity is opposite to that which was anticipated. Turn off the power, reverse the test lead connections (the function switch has no effect on polarity for the 10 AMP range), and turn on the power again.
5. Read the current directly on the black D.C. arc. Use the 0-10 figures. The current values are in amperes.
6. Turn off the circuit power. Remove the test leads and restore circuit continuity.

SCHEMATIC DIAGRAM

MODEL 260 AND MODEL 270

PARTS LIST

CIRCUIT SYMBOL	DESCRIPTION		MODEL 260 PART NUMBER	MODEL 270 PART NUMBER
R 1	Resistor	1138 ohms	26942-1138	36682-1138
R 2	Resistor	110 ohms	26942-110	36682-110
R 3	Resistor	21850 ohms	26942-21.85K	36682-21.85K
R 4	Resistor	117700 ohms	26942-117.7K	36682-117.7K
R 5	Resistor	238 ohms	26942-238	36682-238
R 6	Resistor	37500 ohms	26942-37.5K	36682-37.5K
R 7	Resistor	200000 ohms	26942-200K	36682-200K
R 8	Resistor	800000 ohms	26942-800K	36682-800K
R 9	Resistor	3.75 megohms	26943-3.75M	36683-3.75M
R 10	Resistor	45000 ohms	26942-45K	36682-45K
R 12	Resistor	150000 ohms	26942-150K	36682-150K
R 13	Resistor	1 megohm	26942-1M	36682-1M
R 14	Resistor	4 megohms	26942-4M	36682-4M
R 15	Resistor	15 megohms	26943-15M	3596
R 16	Resistor	11.5 ohms	26942-11.5	36682-11.5
R 17	Bobbin	0.452 ohms	334-0.452	334-0.452
R 18	Resistor	22.5 ohms	26942-22.5	36882-22.5
R 19	Bobbin	2.0 ohms	334-2.0	334-2.0
R 20	Resistor	80 megohms	26944-80M	3595
R 21	Resistor	20.2 megohms	26944-20.2M	3594
R 22	Shunt Ass'y	10 A. 0.025 ohms	3624	3624
R 25	Potentiometer	10000 ohms	1542-54	1542-54
R 26	Resistor	7500 ohms	26962-7.5K	26962-7.5K
R 27	Rheostat	4000 ohms	1759-13	1759-13
R 28	Rheostat	4000 ohms	1759-13	1759-13
R 29	Resistor	5000 ohms	26962-5K	26962-5K
R 30	Resistor	5000 ohms	26962-5K	26962-5K
R 31	Rheostat	4000 ohms	1759-13	1759-13
R 35	Resistor, NTC ("S" models)		3597-500	3597-500
R 36	Resistor	800 ohms	10472-800	10472-800
C 1	Capacitor 0.1 mfd. 400 V.		1661-18	1661-18
D 1	Diode, Germanium		1510-5	1510-22
D 2	Diode, Germanium		1510-5	1510-22
D 3	Diode, Stabistor			1510-6
F 1	Fuse, clip-in 1A 250V		4684-16	4684-16
	Molded phenolic case		1736-1	1736-1
	Leather carrying strap		7426-1	7426-1
	Knob, Range Switch		7017-1A	7017-1A
	Knob, Function Switch		7016-1A	7016-1A
	Knob, Zero Ohms Control		7015-1A	7015-1A
	Meter Cover		3664	3664
Kit	Roll-Top Conversion		7608	7608
Kit	Add-A-Tester Adaptation		Model 401	Model 401
Kit	Fuse Holder Conversion		6863	6863

HOW TO OPEN THE CASE

Removal of the four screws in the back of the case (with a 1/4" screwdriver) provides easy access to the complete interior for adjustment or replacement of parts. Lifting the front panel straight forward out of the case brings meter, batteries and printed circuit out as a unit.

BATTERY REPLACEMENT

Five batteries supply power for resistance measurements - one large (Size D) flashlight cell and four smaller (Size AA) penlight cells.

When it is no longer possible to bring the pointer to zero ohms (see ZERO OHMS ADJUST, p.22) on the R x 1 and R x 100 ranges, replace the large cell. If this occurs on the R x 10,000 range, replace the four small cells.

OBSERVE POLARITY

All cells are held in place with specially designed spring battery contacts, whose polarity is either marked or plainly evident. Be sure that replacement cells are inserted correctly.

FUSE REPLACEMENT

Remove the front panel and extract the burned-out fuse from the fuse clips located below the range switch. Replace only with a 1 amp. 250 V. fuse, type 3AG (1-1/4" x 1/4") or equal.

If your multimeter was produced prior to August 1961, it is equipped with an electrically identical pigtail fuse with soldered connections.

To allow the use of a clip-in fuse, a fuse block conversion kit including fuse and installation instructions is available at nominal cost.

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CAUTION: If the following maintenance operations are to be carried out successfully on a Model 270, it is most important that you have access to precision standard meters, if the original high accuracy of your instrument is to be restored. It is strongly recommended that your Model 270 be returned to the factory or authorized service depot for this type of repair.

SUB-PANEL PARTS REPLACEMENT

Beneath each resistor on the printed circuit board is its circuit designation (e.g. R10) as it is shown on the schematic diagram and in the parts list. This mark will eliminate any doubt which may arise as to the location of any of the resistors.

RECTIFIER REPLACEMENT AND RECALIBRATION

There are two small rectifiers which are located at the top of the printed circuit, near the large 1.5 volt cell. These are used to rectify the A.C. voltages for measurement. They are shown as D-1 and D-2 in the overall circuit diagram.

In the Model 270, these are beneath the small superimposed circuit board which carries the A.C. temperature compensation network and the protective diode.

Both rectifiers act in the meter circuit to effectively create a full wave rectifying action. If either or both should fail, the meter will show incorrect indications.

In case of rectifier failure in the 260, replace the defective rectifier with another 1N478, and be sure to observe polarity when you connect it into the circuit. If a type 1N478 is not available, use any good quality small crystal rectifier as a replacement.

In the Model 270, it is not advisable to substitute if the original characteristics are to be maintained.

After you replace either or both rectifiers, test the accuracy of A.C. voltage indications. If necessary, recalibrate the circuit by adjusting rheostats R-28 and R-31 as follows:

1. Set the function switch at A.C. and the range switch at 250 V.
2. Connect the red test lead in the + jack and the black test lead in the COMMON - jack.
3. From the standard voltage source, apply 250 volts A.C. to the red and black test leads. Adjust rheostat R-31 (which is next to the + meter stud on the printed circuit board) so the meter reads full scale. Turn power off.
4. Set the range switch to 2.5 V. Apply 2.5 volts A.C. to the red and black test leads. Adjust rheostat R-28 (which is next to R-31) so the meter reads full scale. Turn power off.

If no standard voltage supply is available for the above procedure, use this alternate method:

1. Set the function switch at A.C., and the range switch at 2.5 V.
2. Connect the red test lead in the + jack and the black test lead in the COMMON - jack.
3. Connect the test leads to a fresh 1.5 volt flashlight cell. Connect the red test lead to the positive post of the battery and the black test lead to the negative post..

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4. Adjust rheostat R-28 fully clockwise. It is located in the extreme upper left hand corner of the printed circuit board, next to the "+6 V" mark.
5. Rheostat R-31 is located next to R-28, toward the center of the printed circuit board. Adjust it so the meter reads 1.8 volts on the 2.5 V.A.C. ONLY arc.
6. Adjust R-28 so the meter pointer moves back to 1.71 volts on the same arc, (the pointer will indicate 6 on the OHMS scale when it is in this position).

RESISTOR REPLACEMENT

Almost all of the resistors for the Models 260 and 270 are mounted on the accessible face of the printed circuit board for easy trouble-shooting and repair.

When it is necessary to replace any of the resistors in the printed circuit, first obtain an exact equivalent resistor from Bach-Simpson Limited or their distributors, specifying the description and part number shown in the parts list. Then clip the defective resistor off the printed circuit board, leaving the leads in the board to use as connections for the replacement.

Carefully twist the leads for the new resistor around the leads left from the defective resistor, and solder each connection. Trim away all excess and see that you have not caused any short circuit to any other part nearby.

REMOVING THE PRINTED CIRCUIT

It will be necessary to remove the printed circuit board when you require access to its under-side, or to the parts which are located between it and the front panel.

Use the following procedure:

1. Set the function switch at +D.C. and the range switch at 2.5 V.
2. Remove the ZERO OHMS control knob.
3. Remove the two screws through the lower part of the printed circuit board.
4. Remove the two hex nuts from the meter studs on the top of the printed circuit board.
5. Carefully pry out the battery contact at the + terminal for the small 1.5 volt cells. This is connected to the upper left hand corner of the printed circuit board with an orange lead.
6. Lift the printed circuit board away from the front panel. The entire board, with the switch wafers in place, will come up in one piece.
7. After removal, do not turn knobs on front panel or move any rotors on switches until reassembled.

NOTE - If you have a Model 270

8. First remove the subassembly carrying the protective diode and temperature compensating resistors. To do this you remove the two mounting screws and disconnect the three leads attached.

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GENERAL

The Models 260 and 270 are the most versatile pieces of test equipment you can own, having been designed to measure almost all characteristics of electrical and electronic circuits.

In D.C. circuits they will measure the voltage, the current and the resistance. The measurements are made, throughout a very wide range, in terms of ordinary units for all values. Although the upper limit for D.C. voltage with the 260 or 270 is 5000 volts, accessory multiplier probes are available to extend the range to 25,000 volts. By way of contrast, D.C. currents as small as 1 microampere can be detected on the 50 microampere D.C. range.

In A.C. applications, values of voltage as high as 5000 volts RMS can be measured, using a full wave rectifier circuit. Decibel readings, based on the commonly used arbitrary zero level of 1 milliwatt in 600 ohms, can also be taken.

With the Output measuring facility, the A.C. component of a mixed A.C. and D.C. voltage can be determined. The D.C. portion can be measured on the D.C. voltage ranges.

Resistance measurements, ranging from continuity checks down to a fraction of an ohm to determination of values up to 20 megohms, are feasible. Using an external voltage source and the D.C. current ranges (with extreme caution) checks of insulation resistance are also possible.

RECTIFIER CHECKS

Forward and reverse resistances of copper oxide, selenium and crystal rectifiers can be

measured to provide an indication of rectifier condition. The forward resistance should be low and the reverse resistance very high.

CAPACITOR CHECKS

Simple capacitor checks, designed to indicate good, open and short conditions for many types of capacitor, can also be performed with the ohmmeter circuit. These are a guide only, and the results should always be confirmed.

Use the R x 10,000 range for best results.

A good capacitor will allow current to flow, deflecting the meter pointer, while it is charging up to the applied voltage supplied by the multimeter batteries. After swinging to the right, the pointer will gradually return to infinity at the left side of the scale. The greater the capacity, the greater the deflection and the longer it will take for the pointer to return to infinity.

An open capacitor has infinite resistance; no current will flow, and there will be no movement of the pointer. Very small capacitors will produce only a very small deflection with a very rapid return to infinity. The meter must be very closely observed if you are to distinguish between these conditions.

A shorted capacitor will produce a pointer deflection which will persist. The meter will continue to indicate a finite resistance value.

YOU WILL UNDOUBTEDLY DISCOVER MANY MORE USES FOR YOUR MODEL 260 or 270 THAN IT HAS BEEN POSSIBLE TO DESCRIBE. HANDLE IT WITH CARE AND COMMON SENSE AND IT WILL SERVE YOU WELL.

WARRANTY

BACH - SIMPSON LIMITED warrant this instrument to be free from defects in material and workmanship in normal service. Their obligation under this warranty is limited to making good at their factory any instrument which shall be returned intact to them, or to their authorized representative, with transportation charges prepaid, and which examination shall disclose to their satisfaction to have been thus defective. Any unauthorized prior repair or adjustment may invalidate this warranty.

This warranty is not subject to a fixed time limit. However, at their discretion, Bach-Simpson Limited may request evidence of purchase during the 90 day period preceding return.

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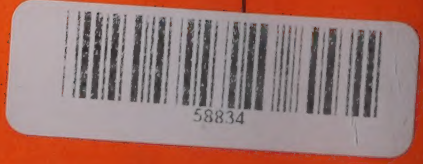
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